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EFFECT OF GA_3 AND IAA ON GROWTH AND FLOWERING OF CARNATION

Vijai Kumar, Vipin Kumar, Vandana Umrao[1] and Monbir Singh

Department of Horticulture, Ch. Shivnath Singh Shandilya (P.G.) College, Machhra, Meerut-250 106 (U.P.) India

[1]Department of Ag. Botany

E- mail:umraovk@gmail.com

ABSTRACT: A field experiment was conducted to find out effect of plant growth promotors (GA_3 and IAA) on growth and flowering of carnation under open field condition of Western Uttar Pradesh. Four levels of each of gibberellic acid (0, 50, 100n and 150 ppm) and IAA (0, 100, 200 and 300 ppm) were sprayed on standing crop of carnation in factorial R.B.D. with three replications. Results revealed that higher concentration of GA_3 (150 ppm) or IAA (300 ppm) applied individually responded favourable effects on most of the paramaters studied. The interaction of higher levels of both the hormones (150 ppm GA_3 300 ppm IAA) influenced significantly to all the characters except no. of side shoots and diameter of stem.

Keywords : *Carnation, GA_3, IAA, growth, flowering.*

Carnation (*Dianthus caryophyllus* L.) is one of the most important commercially grown flowers of the world. Excellent keeping quality, wide range of form and colours, ability to withstand long distance transportation and to rehydrate along with its lighter weight have made carnation flower a unique item in cut-flower trade worldwide. Growth and development of carnation is affected by various factors. Plant growth regulators play a vital role for enhancing quality and yield of many commercial flowers (Lal and Mishra, 4; Meher *et al.,* 5). Gibberellic acid plays a major role in plant growth and development. It has been found to be the best for enhancing vegetative attributes along with flower initiation in many commercial flowers. Indole-3- acetic acid (IAA) stimulates cell division, shoots growth, and regulates cell-tissue morphogenesis and inhibits leaf abscission. Enhanced flowering and quality of flowers in carnation can also be obtained by the exogenous application of growth promoting hormones like gibberellic acid and IAA due to their extraordinary responses on cell division, cell elongation and enlargement in the apical regions of the plant. Keeping in the mind the above facts a field trial was made to observe response of GA_3 and IAA sprayings on carnation cv. Lilliput.

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MATERIALS AND METHODS

The study was carried out at experimental field of Department of Horticulture, Ch. Shivnath Singh Shandilya (P.G.) College, Machhra, Meerut (U.P.) India during 2007-2008. Thirty days old healthy seedlings of carnation cv. Lilliput were transplanted in evening hours at a planting distance of 30 × 20 cm in each plot of 90 × 90 cm. Soil of experimental field was sandy loam containing 0.42% carbon, 0.52% nitrogen, 0.008% phosphorus and 0.019% potash. Four levels of each of GA_3 (0, 50,100 and 150 ppm) and IAA (0, 100, 200 and 300 ppm) with a total of 16 treatment combinations were sprayed twice on standing crop at 30 and 45 days after transplanting. Randomly four plants in each plot were selected for observing data on vegetative growth and flowering parameters. Observations on plant height, number of leaf pairs, number of leaves, number of side shoots, diameter of stem, days to first flower initiation, number of flowers, fresh weight of flower, diameter of flower and flower head yield/plot. The experiment was laid out in Factorial R.B.D. and average data obtained was analyzed statistically as per method suggested by Panse and Sukhatme (6).

RESULTS AND DISCUSSION

A perusal of data (Table 1 & 2) revealed that the height of carnation plant was increased significantly at all stages due to foliar application of GA_3 and IAA. Gibberellic acid at 150 ppm level resulted in significantly the tallest plant (44.63 cm) at 60 days after transplanting. Like this, the higher level of IAA (300 ppm) also resulted in maximum plant height (44.20 cm) followed by 200 ppm IAA as compared to their respective controls. Same trend was also observed in their interaction effects, where combined application of 150 ppm GA_3 and 300 ppm IAA resulted significantly the tallest plant (46.53 cm) followed by 100 ppm GA_3 + 200 ppm IAA confirming the results of Kumar *et al.* (3) and Verma (11) in carnation. Gibberellins, when applied exogenous, elongate plant's cell and tissues, thereby increasing height of plant. Higher doses of GA_3 (150 ppm) and IAA (300 ppm) individually as well as their interaction resulted significantly increased number of leaves and leaf pairs/ plant as well. The highest number of leaves/plant (99.50, 88.53 and 83.42 leaves) was recorded with GA_3 × IAA, IAA and GA_3, respectively over their respective controls. Like this, maximum number of leaf pairs/plant was recorded with 150 ppm GA_3 × 300n ppm IAA (50.53 leaf pairs) followed by 100 ppm GA_3 (44.61 leaf pairs) and 300 ppm IAA (43.76 leaf pairs) confirming the findings of Kumar *et al.* (3) in carnation, Singh (8) in Californian poppy and Tyagi *et al.* (10) in calendula.

Number of side shoots in carnation (Table 1 & 2) was also influenced significantly due to exogenous application of GA_3 and IAA, where 150 ppm GA_3 (12.51 shoots/plant), 300 ppm IAA (12.46 shoots/plant) resulted in the maximum number of shoots over their respective controls, while, their interaction effect could not influence this parameter significantly. Results are in conformity with Dua *et al.* (2) in gladiolus and Sharma *et al.* (7) in chrysanthemum. The thickness of stem of carnation due to growth regulators' spray was also influenced significantly and the higher individual dose of GA_3 (150 ppm) and IAA (300 ppm) resulted in significantly the thickest stem of the carnation plant, while their interaction could not influence this parameter significantly confirming the results of Meher *et al.* (5) in zinnia, Sharma *et al.* (7) in chrysanthemum and Tyagi and Singh (9) in African marigold. Days taken to first flower bud initiation (Table 1 & 2) revealed that there were perceptible variations due to applied growth regulators. Flower bud initiation was enhanced linearly with increasing level of gibberellic acid concentration from 50 to 150 ppm. Higher level of GA_3 (150 ppm), IAA (300 ppm) and the interaction (150 ppm GA_3 × 200 ppm IAA) caused earliest flower bud initiation (39.83 day, 40.67 day and 37.0 day, respectively as compared to their respective control values. Like this, number of days taken for first flower opening decreased linearly with increasing levels of both the hormones tested. The highest level of each of GA_3 (150 ppm) and IAA (300 ppm) and their interaction resulted in significantly the earliest flower opening (52.23 day, 51.58 day and 48.33 day, respectively) as their respective controls (60.17, 60.33 and 65.33 day, respectively). Results are in consonance with Bragt (1) in tulip, Kumar *et al.* (3) in carnation, Sharma et al. (7) in chrysanthemum and Singh (8) in Californian poppy.

Results (Table 1 & 2) revealed that number of flowers was also increased linearly with every increase in concentration of GA_3 and IAA tested. The higher level of gibberellic acid (150 ppm) and IAA (300 ppm) individually as well as their interaction resulted in significantly the highest number of flowers/plant (23.75, 24.12 and 29.73 flowers/plant, respectively) as compared to their respective controls confirming the results of Lal and Mishra (4) in marigold, Shrama *et al.* (7) in chrysanthemum and Verma (11) in carnation. The higher level of GA_3 (150 ppm) or IAA (300 ppm) as well as their interaction resulted in the highest fresh weight of individual flower (1.23g, 1.24g and 1.70g, respectively) over their respective control values which are in line with the results of Singh (8) in Californian poppy and Tyagi and Singh (9) in

Table 1: Effect of GA_3 and IAA sprayings on growth and flowering of carnation.

Parameter	Treatment									
	0 ppm GA_3	50 ppm GA_3	100 ppm GA_3	150 ppm GA_3	C.D. (P=0.05)	0 ppm IAA	100 pm IAA	200 ppm IAA	300 ppm IAA	C.D. (P=0.05)
Plant height (cm)	40.52	43.39	43.22	44.63	0.691	41.02	42.86	43.68	44.20	0.691
No. of leaves/pant	67.43	78.22	83.43	90.05	0.569	79.64	77.30	83.65	88.53	0.569
No. of leaf pairs/plant	35.15	39.43	40.65	44.61	0.646	35.18	39.34	41.56	43.76	0.646
No. of side shoots /plant	9.73	10.88	11.71	12.51	0.733	9.68	11.00	11.69	12.46	0.733
Diameter of stem (cm)	0.66	0.76	0.80	0.83	0.055	0.67	0.76	0.79	0.83	0.055
Days to first flower bud initiation	47.92	43.17	41.92	39.83	0.605	46.75	43.75	41.67	40.67	0.605
Days to opening of first flower	60.17	55.33	53.50	52.33	60.33	0.587	56.00	53.42	51.58	0.587
No. of flowers /plant	16.46	20.48	21.83	23.75	0.566	16.97	19.98	21.45	24.12	0.566
Fresh weight of flower (g)	0.92	1.902	1.07	1.23	0.089	0.92	1.02	1.06	1.24	0.089
Diameter of flower (cm)	3.29	3.64	3.75	3.85	0.079	3.39	3.54	3.77	3.82	0.079
Yield of flower heads/plant (g)	15.01	20.28	22.29	29.65	0.556	16.33	19.36	21.92	29.63	0.556

Table 2: Interaction effect of GA_3 × IAA on growth and flowering of carnation.

Treatment Combination	Parameter										
	Plant height (cm)	No. of leaves /pant	No. of leaf pairs /plant	No. of side shoots /plant	Diam. of stem (cm)	Days to first flower bud initiation	Days to opening of Ist flower	No. of flowers /plant	Fresh weight of flower (g)	Diam. of flower (cm)	Yield of flower heads/ plant (g)
G_0I_0	38.00	60.57	31.50	8.50	0.53	50.53	65.33	12.53	0.73	2.90	9.67
G_1I_0	41.50	64.27	35.30	9.97	0.70	47.67	60.33	17.50	0.93	3.47	17.00
G_2I_0	41.50	74.33	36.03	10.23	0.73	46.00	58.33	18.77	1.00	3.60	19.17
G_3I_0	43.07	79.40	37.87	10.00	0.73	43.00	57.33	19.07	1.00	3.60	19.50
G_0I_1	40.43	62.50	34.67	9.93	0.67	49.00	61.67	16.80	0.93	3.20	14.70
G_1I_1	43.37	82.00	39.33	10.37	0.73	42.33	55.00	20.97	1.03	3.67	20.17
G_2I_1	43.07	82.50	41.37	11.40	0.80	42.00	54.00	20.77	1.03	3.60	20.43
G_3I_1	44.57	82.20	42.00	12.30	0.83	41.67	53.33	21.40	1.o7	3.70	22.13
G_0I_2	41.63	67.27	35.53	10.30	0.70	47.33	58.33	17.30	0.97	3.50	17.50
G_1I_2	43.63	81.43	41.00	10.97	0.80	42.00	54.00	20.30	1.03	3.70	20.50
G_2I_2	43.07	86.40	41.67	11.97	0.83	40.33	51.00	23.40	1.07	3.90	21.63
G_3I_2	44.57	99.50	48.03	13.53	0.83	37.00	50.33	24.80	1.17	4.00	28.03
G_0I_3	42.00	79.40	38.90	10.20	0.73	45.00	55.33	19.20	1.03	3.57	18.17
G_1I_3	45.07	85.17	42.07	12.20	0.80	40.67	52.00	23.17	1.07	3.73	23.47
G_2I_3	43.20	90.43	43.53	13.23	0.83	39.33	50.67	24.37	1.17	3.90	27.93
G_3I_3	46.43	99.10	50.53	14.20	0.83	37.67	48.33	29.73	1.70	4.10	48.93
C.D. (P=0.05)	1.383	1.138	1.291	NS	NS	1.210	1.174	1.132	0.178	0.159	1.112

African marigold. Diameter of individual flower was increased linearly with every increase in levels of both the hormones tested. The largest sized flower was found with the spray of higher concentration of GA_3 (150 ppm) or IAA (300 ppm) or their interaction (3.85 cm, 3.82 cm and 4.10 cm, respectively) as compared to their respective control confirming the reports of Meher *et al.* (5) in zinnia, Singh (8) in Californian poppy and Verma (11) in carnation. Yield of flowers per plant was also influenced remarkably with various levels of growth hormones tested in this investigation. Increasing level of GA_3 or IAA resulted a remarkable increase in yield of flower head per plant, and 150 ppm GA_3 or 300 ppm IAA as well as their interaction (150 ppm GA_3 × 300 ppm IAA) resulted in the highest yield of flower heads per plant (29.65g, 29.63g and 48.93g, respectively) as compared to their respective controls which are in line of results of Singh (8) in Californian poppy, Tyagi and Singh (9) in African marigold and Verma (11) in carnation.

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